

CLAIMS

What is claimed is:

1. A cutter element for a drill bit comprising:
 - a base portion having a central axis;
 - a cutting portion extending from said base portion and having a cutting surface terminating in a rounded nose that is spaced apart from said central axis, said cutting surface including a front surface, a back surface, and a pair of flanking surfaces extending from said base and intersecting at said nose;
 - wherein at least one of said flanking surfaces includes a concave region; and
 - wherein said back surface slopes from said nose to said base portion and is broader adjacent to said base than adjacent to said nose, said back surface forming a wedge-shaped top cutting profile of said cutting surface.
2. The cutter element of claim 1 wherein said cutting surface includes a wedge-shaped side profile.
3. The cutter element of claim 2 wherein each of said flanking surfaces includes a concave region.
4. The cutter element of claim 3 wherein said nose includes a spherical radius R.

5. The cutter element of claim 3 wherein said side profile has a first segment with radius R_1 adjacent to said nose, a middle segment with a radius R_2 that is greater than R_1 , and a trailing segment with a radius R_3 that is greater than R_2 .
6. The cutter element of claim 3 wherein said side profile has a first segment with radius R_1 adjacent to said nose, a middle segment with a radius R_2 that is greater than R_1 , and a trailing segment with a radius R_3 that is greater than R_1 and less than R_2 .
7. The cutter element of claim 3 wherein said top cutting profile has a first segment with radius R adjacent to said nose, a second segment with a radius R_B that is greater than R , and a third segment R_A having an inverted radius, said third segment being positioned at a location that is between said first and second segments.
8. The cutter element of claim 2 wherein said concave region has an elongate shape extending generally in a direction toward said nose.
9. The cutter element of claim 2 wherein said back surface is symmetrical about a plane of symmetry that bisects said back surface; the intersection of said plane of symmetry and said back surface defining a crown line, and wherein said back surface is continuously contoured from said crown line to the intersection of said back surface and said flanking surfaces.
10. The cutter element of claim 9 wherein said back surface is continuously contoured from said nose to said base.

11. The cutter element of claim 1 wherein said base portion includes an outer surface defining the outer profile of said base, and wherein nose is set back from said outer profile by a distance D.
12. The cutter element of claim 11 wherein said distance D is at least equal to said radius R.
13. The cutter element of claim 1 wherein said top profile has a wedge ratio of at least 3 to 1.
14. The cutter element of claim 13 wherein said top profile has a wedge ratio of at least 5 to 1.
15. The cutter element of claim 1 wherein said top profile is pear-shaped.
16. The cutter element of claim 1 wherein said top profile has a generally triangular shape.
17. The cutter element of claim 1 wherein said base portion includes an outer surface defining the outer profile of said base, and wherein said nose extends beyond said outer profile by an extension length E.
18. A cutter element for a drill bit comprising:
 - a base portion having a central axis and a cutting portion extending from said base portion, said cutting portion having a cutting surface including a front surface, a back surface, and a pair of flanking surfaces between said front and back surfaces, said front, back, and flanking surfaces converging together to form a nose on said cutting surface;

wherein said nose spaced from said central axis;

wherein at least one of said flanking surfaces includes a region that is concave; and

wherein said back surface has a leading end at said nose and a trailing end opposite from said nose, said back surface being wider at a location adjacent to said trailing end than at said leading end and being generally wedge-shaped as viewed from above.

19. The cutter element of claim 18 wherein said back surface has a wedge ratio of at least 3 to 1.

20. The cutter element of claim 19 wherein said top cutting profile is generally triangular-shaped.

21. The cutter element of claim 19 wherein said top cutting profile is generally pear-shaped.

22. The cutter element of claim 19 wherein said top cutting profile has a first segment with radius R adjacent to said nose, a second segment with a radius R_B that is greater than R , and a third segment R_A having an inverted radius, said third segment being positioned at a location that is between said first and second segments.

23. The cutter element of claim 22 wherein said top cutting profile has a wedge ratio of 5 to 1 or greater.

24. The cutter element of claim 18 wherein said back surface slopes away from said nose toward said trailing end, said cutting surface having a generally wedge-shaped side profile.

25. The cutter element of claim 24 wherein said cutting surface is symmetrical about a plane of symmetry that bisects said back surface, the intersection of said plane of symmetry and said back surface defining a crown line, wherein said back surface slopes down and away from said crown line as said back surface extends between said crown line and the intersection of said back and said flanking surfaces.

26. The cutter element of claim 24 wherein each of said flanking surfaces includes a concave region.

27. The cutter element of claim 24 wherein said base portion includes an outer surface defining the outer profile of said base, and wherein said nose is set back from said outer profile of a distance D.

28. The cutter element of claim 24 wherein said base portion includes an outer surface defining the outer profile of said base, and wherein said nose extends beyond said outer profile by an extension length E.

29. A drill bit having a nominal gage diameter for drilling a borehole in earthen formations, said bit comprising:

a bit body having a bit axis;

at least one rolling cone cutter rotatably mounted on said bit body and having a plurality of cutter elements disposed in spaced-apart circumferential rows;

a gage row of cutter elements having cutting portions extending to full gage diameter for cutting the corner of the borehole;

an inner row of cutter elements disposed radially inboard of said gage row for cutting the borehole bottom, said inner row cutter elements having a base with a central axis retained in said cone cutter, and a cutting portion extending from said base;

wherein a plurality of said inner row cutter elements have a cutting surface that includes a front surface, a back surface, and a pair of flanking surfaces between said front and back surfaces, said front, back, and flanking surfaces converging together to form a nose on the cutting tip of said cutting surface;

wherein said nose of said cutting surface and is spaced from said central axis, and

wherein at least one of said flanking surfaces includes a region that is concave; and

wherein said back surface has leading end at said nose and a trailing end opposite from said nose, said back surface being wider at a location adjacent to said trailing end than at said leading end and being generally wedge-shaped as viewed from above looking along said central axis.

30. The drill bit of claim 29 wherein said back surface is at least three times wider at a location adjacent to said trailing end than it is at said leading end.

31. The drill bit of claim 30 wherein each of said flanking surfaces includes a region that is concave, and wherein said nose includes a spherical radius.

32. The drill bit of claim 31 wherein said plurality of inner row cutter elements are positioned in said cone cutter such that said front surface of said cutting surface engages the formation material before said back surface.

33. The drill bit of claim 31 wherein said concave regions are elongate and extend generally from the cutter element base toward said nose and away from said central axis of said cutter element base.

34. The drill bit of claim 30 wherein the intersection of said back surface with said front and flanking surfaces forms a top cutting profile of said cutting surface that is generally triangular-shaped.

35. The drill bit of claim 30 wherein the intersection of said back surface with said front and flanking surfaces forms a top cutting profile of said cutting surface that is generally pear-shaped.

36. The cutter element of claim 29 wherein said cutting surface is crestless.